ГЛАСНИК СРПСКОГ ГЕОГРАФСКОГ ДРУШТВА
BULLETIN OF THE SERBIAN GEOGRAPHICAL SOCIETY
ГОДИНА 2009. СВЕСКА LXXXIX - Бр. 4
YEAR 2009 TOME LXXXIX - N° 4

Original Scientific Paper UDC 911.2:551.053:502.75

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NATURAL GEO-COMPOSITES FOR GRASSING OF ERODED AND DEGRADED LANDS

Abstract: Original, natural grass geocomposites (sods) were developed on the basis of combination from unstuffy, needle-drive textile material, geo-net and soil-manure-peat or peat with grass cover from grass mixtures.
The natural grass geocomposites have the next priorities: quickly grassing and reinforcing of eroded and degraded terrains; large uniformity and compactness of grass cove; long exploiting period; grassing of terrains with big slopes where the mechanization is difficult to use; the articles are with low mass, small thickness and high stability; they limit the growing of weed.
The natural grass geocomposites are intend for control of soil erosion and reconstruction of natural landshaft. They can to reinforce ditches, grass collectors, side of the road slopes, as well as lay out lawn, parks, stadiums, ski racing tourist's beauty spot, etc.

Key words: grass geocomposites, erosion, control measures, landshaft, land use.

Извод: Оригиналне, природне траве (бусење) развијено је на бази комбинације из текстилног материјала са одређеним мешавинама трава, тресета и земљишта. Природно бусење има неколико предности: брзо расте и јача и нарушене ерозијом и деградиране терене, велику уједначеност и компактност траве, дуг период експлоатације; затим, затрављивање терена са великим нагибима где је тешко користити механизацију. Делови мале дебљине, са слојем земљишта мале дебљине ограничавају, раст корова.
Природна трава намењена је за контролу ерозије тла као и реконструкцију природних пејзажа. Они се могу користити и као, колектори за траву, на странама путева у парковима, стадионима и областима посебне туристичке лепоте.

Кључне речи:

Introduction

Grass laying related to various business and domestic facilities, fighting soil erosion, re-cultivation and biological conservation of degraded land requires use of perennial species and mixes of these. A typical disadvantage related to this type of application is the critical period of about a month after the species are planted due to the risk of seeds being washed away by rain or blown away by wind.
Many studies were conducted with mulch materials such as straw, polyethylene material, bark, bran and so on in order to eliminate this disadvantage.

Due to the large volume of materials, difficulty related to transfer and fixing to the terrain recently we started efforts to use chemical substances like mulch. We used fast-drying polymers, foams, sulfate lye, water glass, sulfate soap, etc. (Sigalov B.Y., 1957).
In the United States we have the practice of hydro-sowing with use of fiber materials of the so called "fiber mulch" (Hovland D etc., 1966). For the fast grass laying at some sites we can have use of geo-textile with seeds fixing by film-forming polymers (Lozanova, L. et al., 1998) or weaving into the textile (Day A.D., Ludec, K.L., 1986); we can have coconut fibers and straw in the form of rolls which are spread and fixed on the terrain by wooden or steel poles.

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In other case (controlled conditions) we can have a grass turf which is transferred and laid on the terrain stipulated for grass laying.
The goal of the current work was namely to have a natural grass gee-composite (turf) for grass laying on different types of terrains since now those are imported from abroad.

Materials and methods

During the period 1999-2000 we had a vegetation experience at N. Pushkarov PI (Pedology Institute) for the creation of natural grass geo-composites (NGG) and the following variants:

1. NGG composed of needled non-woven textile material (NTM) containing over 50% restored wool fibers with area mass of 480 g/m^2, surface-fertilizer mix with layer thickness of 10 mm and wheat mix of English rye-grass *(Lolium perenne* L.) 40% + red fescue *(Festuca rubra* L.) 30% + smooth-stalked meadow grass *(Poa pratensis* L.) 30%.
2. The same as variant 1 but the grass mix will have wheat and bean species and containing white clover *(Trifolium repens* L.) 20% + red fescue 40% + smooth-stalked meadow grass 40%.
3. The same as variant 2 but the grass mix will have Birdsfoot trefoil *{Lotus corniculatus* L.) 20% instead of white clover.
4. The same as variant 1 but instead of NTM we can have use of geo-textile (synthetic fibers) with areas mass of 200 g/m^2 and dimensions of openings 1.25/1.25; 0.75/0.75 H 0.4/0.4 cm below the soil-fertilizer-turf mix.
5. The grass mix will be as in variant 1; it will be plated in enriched turf with macro and micro elements without NTM and geo-textile.
6. The variants were set in four repetitions with dimensions of NTM 40/30 cm. Sowing was realized in the beginning of April with sowing norm of grass mixes of 30 g/m^2.

Results and discussion

Before we started the experiment we had a chemical analysis of soil-fertilizer-turf mix for content of basic food elements. Data showed that the humus content was 35.5%, NH_4-N -12.8 mg/1000 g, $N0_3$-N - 735 mg/1000 g, P205 - 234.5 mg/100 g, K_2O - 677 mg/100 g and pH (KC1) - 7.0.

The turf we used was imported from Latvia and its humus content was 56.3%, NH_4-N - 38.6 mg/1000 g, NO_3-N - 3.0 mg/1000 g, P_2O_5 - 24.4 mg/100 g, K_2O - 319 mg/100 g and PH (KC1) - 6.3. It was enriched by Mg, S, B, Mn, Cu, Zn, Co and Mo.

Results of the study showed that in the first three variants NTM did not present difficulties for seeds growth (grass mixes). The root system of grass developed easily at NTM and we had a homogeneous material, very stable with regard to tear.

Under conditions of 80% moisture of USWC (utmost soil water capacity), grass mixes developed for about 10 days. For the development of a natural turf the species which developed on NTM were put in the soil-and-turf mix with layer thickness of 30 mm. After reaching height of 8-10 cm grass was mowed for faster processing and condensing of turf. For 30^0 days of development we achieved high density and uniformity of plant distribution which reached 90-100%.

We obtained grass geo-composites (turfs) with mass 15 Kg/m^2, thickness of 35 mm and high level of strength. The use of NTM limited the development of weeds and this provided for high aesthetic appearance of obtained grass cover.

The same good results were obtained also with regard to variants with geo-textile and turf. In these cases, however, we did not have limitation of the growth of weeds and in variants only with turf the obtained turf had lower level of strength but at the same time it was lighter - 9 Kg/m^2 due to the lower volumetric mass of turf.

In the spring of 2000 we had preparation of five production models of NGG of mebelin TM-40 with dimensions 2/0.5 m and areas mass of 350 g/m^2, produced by the company NonVoTex AD (Sofia); soil-and-turf mix and grass mix for parks and gardens containing the following species: Festuca rubra commutata (25%) + Festuca rubra rubra(25%) + Poa pratensis(30%) + Festuca ovina (10%) + Lolium perenne (10%).

The produced natural grass geo-composites were implanted on maroon (forest) soil; the soil was treated in advance at depth of 20 cm and more with 30 g/m^2 ammonium nitrate and double super-phosphate. Over the treated (to a state of garden readiness) soil we spread the NGG rolls an then they will be treated by steam roller and watered. Observations showed that success probability is 100% and obtained grass cover (if it received proper care during the vegetation period - fertilizers, watering, rolling and mowing) will obtain an appearance of a natural grass cover.

Conclusion

The created natural geo-composites are stipulated for limitation of soil erosion and restoration of natural landscapes in the process of gullies, grass collectors, road sections,tailings ponds and cinder facilities reinforcement and also for laying of parks, gardens, ski tracks, stadiums, tourist facilities, etc. They will have the following advantages:

- Fast grass laying and reinforcement of eroded and degraded terrains;
- High level of uniformity and density of grass cover - 90-100%;

• Long operation period;
• The product has a low mass, low thickness and high level of strength.
• Grass laying of terrains with high slopes where no machinery can be used.
• Limitation of weed growth.

The product was registered in the patent office of the Republic of Bulgaria as an useful model.

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Р е з и м е

ПРИРОДНО БУСЕЊЕ ЗА ЗАТРАВЉИВАЊЕ ЕРОДИРАНИХ И ДЕГРАДИРАНИХ ЗЕМЉИШТА

Природно бусење предвиђено је за ограничење ерозија тла и обнове природних пејзажа у јаругама, колекторима трава, путних деоница, јаловинама као и у парковима, вртовима, ски стазама, стадионима, туристичкиим објекатима, итд. Наводи се неколико предности:

• Брз раст траве као и опоравак деградираних терена;
• Висок ниво једноличности и густине травнатог покривача - 90-100%;
• Дуг период коришћења;
• Мала маса производа, ниска густине и високог нивоа снаге.
• Трава се може посадити на високим обронцима, где се не могу користи машина.
• Ограничавање раста корова.

Овај производ је уписан у завод за патенте Републике Бугарске као користан модел.